CLAIMS

1. Modified cross-section polyester fibers comprising, as a principal component, a polyester polymer and having a modified cross-section,

wherein

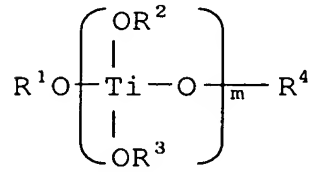
the polyester polymer is produced by polycondensation of an aromatic dicarboxylate ester in the presence of a catalyst,

the catalyst comprises at least one ingredient selected from among mixture (1) and reaction product (2) below,

the mixture (1) is a mixture of the following components (A) and (B):

(A) a titanium compound component comprising at least one compound selected from the group consisting of:

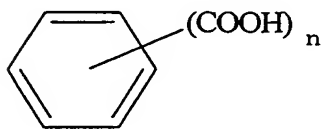
(a) titanium alkoxides represented by the following general formula (I):



(I)

[wherein R^1, R^2, R^3 and R^4 each independently represent one species selected from among alkyl groups having 1 to 20 carbon atoms and phenyl groups, m represents an integer of 1-4, and when m is an integer of 2, 3 or 4, the two, three or four R^2 and R^3 groups may be the same or different], and

(b) reaction products of titanium alkoxides of general formula (I) above with aromatic polyvalent carboxylic acids represented by the following general formula (II):

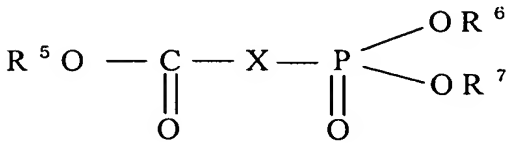


(II)

[wherein n represents an integer of 2-4]

or their anhydrides, and

(B) a phosphorus compound component comprising at least one compound represented by the following general formula (III):



(III)

[wherein R^5, R^6 and R^7 each independently represent alkyl groups having 1 to 4 carbon atoms, and X represents at least one species selected from among $-CH_2-$ group and $-CH_2(Y)$ group (where Y represents phenyl group)],

the mixture (1) for the catalyst is used with a mixing ratio such that the ratio (%) M_{Ti} of the millimoles of titanium element in the titanium compound component (A) with respect to the number of moles of the aromatic dicarboxylate ester and the ratio (%) M_p of the millimoles of phosphorus element in the phosphorus compound component (B) with respect to the number of moles of the aromatic dicarboxylate ester satisfy the following expressions (i) and (ii):

$$1 \leq M_p/M_{Ti} \leq 15 \qquad \text{(i)}$$

$$10 \leq M_p+M_{Ti} \leq 100 \qquad \text{(ii)},$$

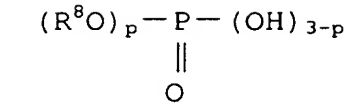
and the reaction product (2) is the reaction product of the following components (C) and (D):

(C) a titanium compound component comprising at least one compound selected from the group consisting of:

(c) titanium alkoxides represented by formula (I) above and

(d) reaction products of titanium alkoxides of general formula (I) above with aromatic polyvalent carboxylic acids represented by general formula (II) above or their anhydrides, and

(D) a phosphorus compound component comprising at least one phosphorus compound represented by the following general formula (IV):



(IV)

[wherein R^8 represents alkyl groups having 1 to 20 carbon atoms or aryl groups having 6 to 20 carbon atoms, and p represents an integer of 1 or 2].

2. The modified cross-section polyester fibers according to claim 1, wherein component (A) of the mixture (1) for the catalyst and component (C) of the reaction product (2) for the catalyst contain the respective titanium alkoxide (a) and titanium alkoxide (c) each in a reaction molar ratio in the range of 2:1 to 2:5 with respect to the aromatic polyvalent carboxylic acid represented by general formula (II) or its anhydride.

3. The modified cross-section polyester fibers according to claim 1 or 2, wherein in the reaction product (2) for the catalyst, the reaction ratio of component (D) with respect to component (C) is in the range of 1:1 to 3:1, in terms of the ratio of the moles of phosphorus atoms in component (D) to the moles of titanium atoms in component (C) (P/Ti).

4. The modified cross-section polyester fibers according to any one of claims 1 to 3, wherein the phosphorus compound of general formula (IV) used in the reaction product (2) for the catalyst is selected from among monoalkyl phosphates.

5. The modified cross-section polyester fibers according to any one of claims 1 to 4, wherein the aromatic dicarboxylate ester is a diester produced by transesterification of an aromatic dicarboxylic acid dialkyl ester and an alkylene glycol ester, in the presence of a titanium compound-containing catalyst.

6. The modified cross-section polyester fibers according to any one of claims 1 to 5, wherein the aromatic dicarboxylic acid is selected from among

terephthalic acid, 1,2-naphthalenedicarboxylic acid, phthalic acid, isophthalic acid, diphenyldicarboxylic acid and diphenoxyethanedicarboxylic acid, and the alkylene glycol is selected from among ethylene glycol, butylene glycol, trimethylene glycol, propylene glycol, neopentyl glycol, hexanemethylene glycol and dodecanemethylene glycol.

7. The modified cross-section polyester fibers according to any one of claims 1 to 6, wherein the lateral cross-section of the single fiber is a flat shape, and the flat shape is a form with 3-6 round cross-sectional shapes joined in the lengthwise direction.

8. The modified cross-section polyester fibers according to claim 7, which comprises inorganic particles at 0.2-10 wt% based on the fibers weight.

9. The modified cross-section polyester fibers according to claim 7 or 8, wherein in the lateral cross-section of the fiber, the flatness represented by A/B as the ratio of the width A of the long axis to the maximum width B of the short axis perpendicular to the long axis B is 3-6.

10. The modified cross-section polyester fibers according to any one of claims 7 to 9, wherein in the lateral cross-section of the single fiber, the irregularity represented by B/C as the ratio of the maximum width B of the short axis to the minimum width C (minimum width at the joints of the round cross-sectional shapes) is larger than 1 and smaller than 5.

11. The modified cross-section polyester fibers according to any one of claims 1 to 6, wherein the lateral cross-section of the single fiber comprises a core and 3-8 fins protruding outward from the core, and the protrusion coefficient as defined by formula (iii) below is between 0.3 and 0.7.

Protrusion coefficient = $(a_1-b_1)/a_1$ (iii)

[where a_1 represents the length from the center of an inscribed circle in the inner wall of the single fiber

cross-section to the tip of the fin, and b_1 represents the radius of the inscribed circle in the inner wall of the fiber cross-section.]

12. The modified cross-section polyester fibers according to claim 11, wherein the fiber crystallinity is no greater than 30%.

13. The modified cross-section polyester fibers according to claim 11 or 12, wherein the fiber boiling water shrinkage ratio is 15-70%.

14. The modified cross-section polyester fibers according to any one of claims 1 to 6, wherein the polyester single fiber comprises a core and multiple fins protruding in a radial fashion from the core along the lengthwise direction of the core, and the single fibers with cross-sectional shapes satisfying all of the following relationships (iv) to (vi) are subjected to alkali reduction treatment to separate at least some of the fins from the cores.

$$1/20 \leq S_B/S_A \leq 1/3 \quad \text{(iv)}$$

$$0.6 \leq L_B/D_A \leq 3.0 \quad \text{(v)}$$

$$W_B/D_A \leq 1/4 \quad \text{(vi)}$$

(where S_A represents the cross-sectional area of the core, D_A represents the core diameter if the cross-section is a circle or the circumscribed circle diameter if it is not a circle, and S_B, L_B and W_B represent the cross-sectional area, maximum length and maximum width of the fins, respectively.)

15. The modified cross-section polyester fibers according to claim 14, wherein a compound having a compatibility parameter χ represented by relationship (vii) below of 0.1-2.0 is included in the polyester fiber prior to alkali treatment at 0.5-5.0 wt% with respect to the polyester fiber weight.

$$\chi = (V_a/RT)(\delta a-\delta b)^2 \quad \text{(vii)}$$

(where V_a represents the molar volume (cm^3/mol) of the polyester, R represents the gas constant (J/mol·K), T

represents the absolute temperature (K) and δa and δb represent the solubility parameters ($J^{1/2}/cm^{3/2}$) of the polyester and compound, respectively.)

16. The modified cross-section polyester fibers according to any one of claims 1 to 6, wherein the lateral cross-section of the single fiber is a shape comprising a triangular shaped section and a protrusion extending from one vertex of the triangular shape, where both of the following relationships (viii) and (ix) are satisfied, and having a hollow portion in the triangular shaped section constituting 3-15% thereof.

$$0.7 \leq L1/L2 \leq 3.0 \qquad \text{(viii)}$$

$$3.0 \leq h2/h1 \leq 10.0 \qquad \text{(ix)}$$

(where L1 represents the distance from the connection point between the triangular shaped section and the protrusion to the end of the protrusion, L2 represents the distance between the connection point between the triangular shaped section and the protrusion and the side of the triangular shaped section opposite the connection point, h1 represents the width of the protrusion and h2 represents the length of the side of the triangular shaped section opposite the connection point between the triangular shaped section and the protrusion.)

17. The modified cross-section polyester fibers according to claim 16, wherein an organic sulfonic acid metal salt represented by general formula (V) below is included at 0.5-2.5 wt% with respect to the weight of the polyester fibers.

$$R^9SO_3M \qquad \text{(V)}$$

(where R^9 represents alkyl group having 3 to 30 carbon atoms or aryl or alkylaryl group having 7 to 40 carbon atoms, and M represents an alkali metal or alkaline earth metal.)